IN THE CLAIMS

Please Amend the Claims as follows:

1. Of the Claims still pending in the matter Please Cancel Claims 1-4; 6-11; 13- 18; 20-28; 30 and 44.
2. Please Amend Claims 5, 12, 19 and 29 as provided herein.
3. Please Add New Claims 45 – 49 at provided herein.

AMENDED CLAIMS

Please Amend the following Claims:

Claim 5 (AMENDED). [The method of Claim 4 wherein implementing the partial correction step to compensate for measurement error is supplemented by using a weighted least squares regression to emphasize more reliable measurements with respect to less reliable measurements.] A method of tracking the orientation of a sensor, the method comprising:

a) measuring an angular velocity of the sensor to generate angular rate values;

b) integrating the angular rate values;

c) normalizing the integrated angular rate values to produce an estimate of sensor orientation;

d) measuring a magnetic field vector to generate local magnetic field vector values;

e) measuring an acceleration vector to generate local gravity vector values; and

f) correcting the estimate of sensor orientation using the local magnetic field vector and local gravity vector.

wherein correcting the estimate of sensor orientation using the local magnetic field vector and local gravity vector comprises:

g) determining a measurement vector from the local magnetic field vector values and the local gravity vector values;

h) calculating a computed measurement vector from the estimate of sensor orientation;

i) comparing the measurement vector with the computed measurement vector to generate an error vector that defines a criterion function;

j) performing a mathematical operation that results in the minimization of the criterion function and outputs an error estimate;

wherein the operation of performing a mathematical operation that results in the minimization of the criterion function includes implementing a partial correction step to compensate for measurement error;

wherein implementing the partial correction step to compensate for measurement error is supplemented by using a weighted least squares regression to emphasize more reliable measurements with respect to less reliable measurements;

k) integrating the error estimate;

l) normalizing the integrated error estimate to produce a new estimate of sensor orientation; and

m) repeating steps a)-m), wherein the new estimate of sensor orientation is used for h), calculating a computed measurement vector until tracking is no longer desired.

Claim 12 (AMENDED). [The method of Claim 10 wherein implementing the partial correction step to compensate for measurement error is supplemented by using a weighted least squares regression to emphasize more reliable measurements with respect to less reliable measurements.] A method of tracking the orientation of a sensor, the method comprising:

a) measuring an angular velocity of the sensor to generate an angular rate quaternion;

b) integrating the angular rate quaternion;

c) normalizing the integrated angular rate quaternion to produce an estimated sensor orientation quaternion; and

d) measuring a magnetic field vector to generate local magnetic field vector values;

e) measuring an acceleration vector to generate local gravity vector values;

f) correcting the estimated sensor orientation quaternion using the local magnetic field vector and local gravity vector;

wherein correcting the estimated sensor orientation quaternion using the local magnetic field vector and local gravity vector comprises:

g) determining a measurement vector from the local magnetic field vector values and the local gravity vector values;

h) calculating a computed measurement vector from the estimated sensor orientation quaternion;

i) comparing the measurement vector with the computed measurement vector to generate an error vector that defines a criterion function;

j) performing a mathematical operation that results in the minimization of the criterion function and outputs an error estimate quaternion;

wherein the operation of performing a mathematical operation that results in the minimization of the criterion function comprises minimizing the criterion function without calculating the criterion function;

wherein the operation of performing a mathematical operation that results in the minimization of the criterion function includes implementing a partial correction step to compensate for measurement error;

wherein implementing the partial correction step to compensate for measurement error is supplemented by using a weighted least squares regression to emphasize more reliable measurements with respect to less reliable measurements;

k) integrating the error estimate quaternion;

l) normalizing the integrated error estimate quaternion to produce a new estimated sensor orientation quaternion; and

m) repeating steps a)-m), wherein the new estimated sensor orientation quaternion is used for h), calculating a computed measurement vector.

Claim 19 (AMENDED). [The method of Claim 18 wherein implementing the partial correction step to compensate for measurement error is supplemented by using a weighted least squares regression to emphasize more reliable measurements with respect to less reliable measurements.] A method of tracking the orientation of a sensor, the method comprising:

a) providing a starting estimate of sensor orientation;

b) measuring a magnetic field vector to generate local magnetic field vector values;

c) measuring an acceleration vector to generate local gravity vector values;

d) determining a measurement vector from the local magnetic field vector values and the local gravity vector values;

e) calculating a computed measurement vector from the estimate of sensor orientation;

f) comparing the measurement vector with the computed measurement vector to generate an error vector that defines a criterion function;

g) performing a mathematical operation that results in the minimization of the criterion function and outputs an error estimate;

wherein the operation of performing a mathematical operation that results in the minimization of the criterion function includes implementing a partial correction step to compensate for measurement error;

wherein implementing the partial correction step to compensate for measurement error is supplemented by using a weighted least squares regression to emphasize more reliable measurements with respect to less reliable measurements;

h) integrating the error estimate;

i) normalizing the integrated error estimate to produce a new estimate of sensor orientation; and

j) repeating steps a)-j), wherein the new estimate of sensor orientation is used for e), calculating a computed measurement vector.

Claim 29 (AMENDED). [The method of Claim 26 wherein implementing the partial correction step to compensate for measurement error is

supplemented by using a weighted least squares regression to emphasize more reliable measurements with respect to less reliable measurements.] A method of tracking the orientation of a sensor, the method comprising:

a) providing a starting estimate of sensor orientation quaternion;

b) measuring a magnetic field vector to generate local magnetic field vector values;

c) measuring an acceleration vector to generate local gravity vector values;

d) determining a measurement vector from the local magnetic field vector values and the local gravity vector values;

e) calculating a computed measurement vector from the estimate of sensor orientation, using quaternion mathematics;

f) comparing the measurement vector with the computed measurement vector to generate an 6x1 error vector that defines a criterion function; and

g) performing a mathematical operation that results in the minimization of the criterion function and outputs a 4x1 quaternion error estimate;

wherein the operation of g), performing a mathematical operation that results in the minimization of the criterion function and outputs a 4x1 quaternion error estimate further includes implementing a partial correction step to compensate for measurement error;

wherein implementing the partial correction step to compensate for measurement error is supplemented by using a weighted least squares regression to emphasize more reliable measurements with respect to less reliable measurements;

h) integrating the quaternion error estimate;

i) normalizing the integrated quaternion error estimate to produce a new estimated sensor orientation quaternion; and

j) repeating steps a)-j), wherein the new estimated sensor orientation quaternion is used for e), calculating a computed measurement vector.

ADDED NEW CLAIMS

CLAIM 45 (NEW)

A method of tracking the orientation of a sensor, the method comprising:

a) measuring a magnetic field vector to generate local magnetic field vector values;

b) measuring an acceleration vector to generate local gravity vector values;

c) determining a measurement vector from the local magnetic field vector values and the local gravity vector values;

d) calculating a computed measurement vector from the estimate of sensor orientation

e) comparing the measurement vector with the computed measurement vector to generate an error vector that defines a criterion function; and

f) performing a mathematical operation that results in the minimization of the criterion function using reduced order Gauss-Newton iteration.

CLAIM 46 (NEW). A method of tracking as in Claim 45 wherein the reduced order Gauss-Newton iteration of Claim I takes into account that there are only three independent elements in a quaternion.

CLAIM 47 (NEW). A method of tracking as in Claim 45 wherein the reduced order Gauss-Newton iteration requires the inversion of a matrix with a dimensionality of no more than 3 x 3.

CLAIM 48 (NEW). A method of tracking as in Claim 45 wherein the reduced order Gauss-Newton iteration utilizes a reduced order 6 x 3 *X* matrix entirely composed of elements of the computed measurement vector.

CLAIM 49 (NEW). A method of tracking the orientation of a body limb segment of a tracked subject compared to sensor orientation, comprising:

a) determining a correction to compensate for the difference between sensor coordinates and body limb segment coordinates;
b) placing the tracked subject in a single predetermined reference position;
c) wherein the body limb segment axes are aligned with corresponding Earth-fixed axes or differ by a known offset; and
d) wherein the correction found while the tracked subject is in the predetermined reference position consists of the inverse of the orientation reported by the sensor and the inverse of any known offset.

CLAIM 49 (NEW). A method of tracking the orientation of a body limb segment of a tracked subject compared to sensor orientation, comprising:

a) determining a correction to compensate for the difference between sensor coordinates and body limb segment coordinates;

b) placing the tracked subject in a single predetermined reference position;

c) wherein the body limb segment axes are aligned with corresponding Earth-fixed axes or differ by a known offset; and

d) wherein the correction found while the tracked subject is in the predetermined reference position consists of the inverse of the orientation reported by the sensor and the inverse of any known offset.